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MOSQUITO SURVEY and CONTROL

TWIN BUTTES, WASHINGTON

COLUMBIA NATIONAL FOREST

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### Table of Contents

Introduction	Page 1
Factors Involved in the	
Abundance of Mosquitoes	Page 1
Table of dates, larvae taken,	
location, and species	Page 3
Steamboat Mountain Area	Page 4
Mosquito Lakes Area	Page 4
C.C.C. Meadow Area	Page 5
Squaw Butte Meadows Area	Page 5
Cayuse Meadows Area	Page 5
Sheeplakes Area	Page 5
South Meadows Area	Page 6
Surprise Lakes Area	Page 6
Sawtooth Mountain Area	Page 7
East Butte Meadows Area	Page 7
Hungry Peak Area	Page 8
Skookum Meadows Area	Page 8
Surprise Meadows Area	Page 8
Lone Butte Meadows Area	Page 8
Swampy Meadows Area	Page 8
McClellan Meadows Area	Page 8
Direct Control Measures	Page 9
Natural Enemies of Mosquitoes	
at Twin Buttes	Page 9
Semi-Permanent Control	Page 9
Repellents	Page 10
Summary	Page 11



## INTRODUCTION

Information regarding the so-called snow or mountain species of mosquitoes is meager and their life histories, habits, and methods of control have not as yet been fully studied.

Since they have presented a real problem to workers and animals in areas where they breed in abundance, it has been considered important to secure this information. An opportunity for a preliminary study of this nature presented itself when it was learned that a C. C. C. Camp was to be established at Twin Buttes, Washington, and that mosquitoes were produced in perhaps greater numbers in that vicinity than in any other of the National Forests of the North Pacific Region. The area is large, and the innumerable meadows which are covered with melting snow water for several weeks in late spring furnish excellent breeding grounds for the development of mosquitoes.

This insect pest greatly reduces the efficiency and comfort of laborers and it was for this reason that an effort was made to attempt control measures. It has been found that from a recreational standpoint, the mosquito pest is a most serious one. Campers, fishermen, tourists, and the like will not tolerate the annoyance of mosquitoes by day and night. This fact is important in the Columbia National Forest, as it is a favorite area for huckleberry pickers and thousands of visitors who register there yearly. Mosquito Control then can be considered not only desirable but essential where labor can be obtained economically. Such control brings about more efficient labor and also far more ideal conditions for visitors seeking recreation and rest, relieved as they are from the torments of the mosquito pest.

## FACTORS INVOLVED IN THE ABUNDANCE OF MOSQUITOES

Water is a necessary medium for part of the life cycle of any mosquito, and the larval and pupal stages are only adapted to an aquatic life. Because mosquitoes are often seen flying out of grass and dense vegetations in clouds as one walks through swamps and fields, it is often considered that they breed there. Such is not the case however, as they are simply resting in damp and cool shelters from the sun and wind. Although it is commonly considered that mosquitoes lay their eggs on stagnant water, it has been found that several species of mosquitoes have other characteristic means of egg deposition. In the case of the mountain species the eggs are laid on the damp ground and are hatched when flooded by snow or rain water the following year. Some definite form of instinct is shown by



the female mosquito in selecting the proper place in which to lay her eggs, as they are laid in shallow depressions, particularly in meadows bordering ponds which are flooded for a short period each year by the annual freshets. The eggs are not deposited where the ground is subjected to swiftly moving water.

From the egg stage, tiny white larvae or "wigglers" are hatched by the cold snow water. Their development then depends directly upon the amount of sunshine and the height of temperature to which they are subjected and it is usually found that they develop and pupate in from 8 to 30 days. They remain as pupae for an additional period of from 2 to 6 days. It is in these aquatic stages, i.e., as larvae and pupae, that control by oiling is most effective, and their destruction is best accomplished. This is brought about, not so much by the toxic effect of the oil as by suffocation, the oil coating the surface of the water with an impenetrable film which prevents wigglers from thrusting their air breathing tubes through the surface of the water thus cutting off their supply of oxygen. After an area is sprayed a kill is completed in about thirty minutes.

In making a mosquito control survey, the first and most important work is to find these breeding areas and inspect them regularly. As soon as the young wigglers appear the water must be treated lightly with oil.

In the vicinity of Twin Buttes there are dozens of large and small meadows, some which contain permanent water in the center and others which dry up in early summer. These meadows are flooded in early spring by melting snow water, and their margins are in direct proportion to the amount of snow. Consequently, after winters of light snowfall a short crop of mosquitoes is produced. During the past winter the snowfall was only moderate and the breeding areas were more limited than has been known in other years. A very close check was kept of the breeding conditions in the whole area and a complete record was made of the species, abundance, and oiling operations. This information was obtained over an area of approximately 75 square miles in a five mile radius of the C. C. C. Camp at Twin Buttes.



The following table shows the dates mosquito larvae were taken, the location, and the species during 1934:

Table No. 1

DATE	AREA	SPECIES
Apr. May 1934	W.T.B.1A	Aedes hexadontus
Apr. May 1934	W.T.B.1E	Aedes hexadontus
Apr. May 1934	W.T.B.2C	Aedes hexadontus
June 12, 1934	W.T.B.2C	Aedes hexadontus
Apr. May 1934	W.T.B.2C	Aedes aboriginis & A. cinereus
May, June 1934	W.T.B.2E	Aedes communis
May, June 1934	W.T.B.2F	Aedes aboriginis
Apr. May 1934	W.T.B.3A	Aedes hexadontus
Apr. May 1934	W.T.B.3B	Aedes hexadontus
May, June 1934	W.T.B.3D	A. cinereus & A. aboriginis & Aedes hexadontus
Apr. May 1934	W.T.B.4A	Aedes hexadontus
" " 1934	W.T.B.4B	Aedes hexadontus & A. fitchii
" " 1934	W.T.B.5B	Aedes hexadontus & A. fitchii
" " 1934	W.T.B.6A	Aedes fitchii
" " 1934	W.T.B.6D	Aedes hexadontus
" " 1934	W.T.B.7A	Aedes hexadontus
May, June 1934	W.T.B.7B	Aedes hexadontus
Apr. May 1934	W.T.B.7D	Aedes hexadontus
" " 1934	W.T.B.7H	Aedes hexadontus
May, June 1934	W.T.B.7H	Aedes hexadontus
Apr. May 1934	W.T.B.8E	Aedes hexadontus & A. fitchii
" " 1934	W.T.B.8E	Aedes hexadontus & A. fitchii
" " 1934	W.T.B.8G	Aedes hexadontus & A. fitchii
" " 1934	W.T.B.8N	Aedes fitchii
" " 1934	W.T.B.9A	Aedes aloponotum
" " 1934	W.T.B.9B	Aedes aloponotum & A. communis
" " 1934	W.T.B.9E	Aedes hexadontus
" " 1934	W.T.B.9I	Aedes fitchii
" " 1934	W.T.B.9C	Aedes communis
June 12, 1934	W.T.B.9Z4	Aedes hexadontus
Apr. May 1934	W.T.B.9C	Aedes communis
" " 1934	W.T.B.10A	Aedes cinereus
May, June 1934	W.T.B.11A	Aedes hexadontus
" " 1934	W.T.B.12A	Aedes aboriginis
" " 1934	W.T.B.15A	Aedes aboriginis



The main breeding areas at Twin Buttes are in the marginal waters about ponds or in the shallow water temporarily covering the numerous meadows. This marginal ground usually contains a submerged water moss, Fontinalis, and a wide zone of sedge, Eleocharis palustris. Surrounding these there next follows a zone of willow, Salix sitchensis, with some alder and Spirea douglassi at its outer edges. As the ground becomes higher spruce, fir, pine, huckleberry, and snowberry are found.

The following areas have been discovered, given code numbers, and described in the following tables. They are also located on the accompanying maps.

#### STEAMBOAT MOUNTAIN AREA

This area is  $3\frac{1}{2}$  miles North East of Twin Buttes Ranger Station. Elevation 4000 feet. The eleven ponds are bordered by heavy margins of sedge, buckbrush, and timber:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.1A	Permanent	200 X 80 yds.	20'	None
W.T.B.1B	Permanent	250 X 125 yds.	Very deep	None
W.T.B.1C	Permanent	60 X 50 yds.	Very deep	None
W.T.B.1D	Dry in summer	60 X 30 yds.	Shallow	None
W.T.B.1E	Permanent	100 X 45 yds.	Very deep	Excellent
W.T.B.1F	Permanent	$\frac{1}{2}$ Acre	Shallow	Moderate
W.T.B.1G	Dry in summer	20 X 15 ft.	Shallow	Moderate
W.T.B.1H	Permanent	$1\frac{1}{2}$ Acres	Very deep	None
W.T.B.1I	Permanent	$\frac{1}{2}$ Acre	Shallow	Moderate
W.T.B.1J	Dry in summer	20 X 15 ft.	Shallow	Excellent
W.T.B.1K	Permanent	$1\frac{1}{2}$ Acres	Deep	None

#### MOSQUITO LAKES AREA

This area is one mile East of Twin Buttes Ranger Station. Elevation 3600 feet. There are two moderate sized lakes with seven adjacent breeding grounds. These marginal meadows are dry in late summer:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.2A	Permanent	500 X 200 yds.	Deep	None
W.T.B.2B	Permanent	75 X 40 yds.	Deep	None
W.T.B.2C	Dry in late summer	$\frac{1}{2}$ X $\frac{1}{2}$ mile	Shallow	Excellent
W.T.B.2D	Dry in late summer	150 X 110 yds.	Shallow	Moderate
W.T.B.2E	Semi-permanent	$\frac{1}{2}$ Acre	Shallow	Excellent
W.T.B.2F	Dry in late summer	300 yds. X $\frac{1}{2}$ mi.	Shallow	Excellent
W.T.B.2G	Dry in late summer	25 X 20 yds.	Shallow	Moderate
W.T.B.2H	Dry in late summer	220 X 200 yds.	Shallow	Moderate
W.T.B.2I	Dry in late summer	$\frac{1}{4}$ X $3/8$ mi.	Shallow	Moderate



### C.C.C. MEADOW AREA

This area is  $\frac{1}{2}$  mile North West of the Ranger Station. Elevation 3000 feet. There are four meadows widely separated in the woods, and all have heavy growths of sedge and willow brush along their borders:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.3A	Dry in summer	10 Acres	Shallow	Moderate
W.T.B.3B	Dry in summer	40 Acres	Shallow	Moderate
W.T.B.3C	Dry in summer	50 Acres	Shallow	Moderate
W.T.B.3D	Dry in summer	400 X 100 yds.	Shallow	Excellent

### SQUAW BUTTE MEADOWS AREA

This area is one and one-half miles North West of the Ranger Station. Elevation 4100 feet. The meadows have brushy borders of willow and heavy growths of sedge in the centers:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.4A	Dry in summer	15 Acres	Shallow	Excellent
W.T.B.4B	Permanent	15 Acres	Deep	Moderate on margins
W.T.B.4C	Dry in summer	20 Acres	Shallow	Moderate

### CAYUSE MEADOWS AREA

This area is two and one-half miles South West of the Ranger Station. Elevation 3400 feet. The meadows have heavy covers of sedge in the centers and dense growths of willows about the borders:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.5A	Dry in summer	$\frac{1}{2}$ X $\frac{1}{2}$ mi.	Shallow	Moderate
W.T.B.5B	Dry in summer	16 Acres	Shallow	Moderate
W.T.B.5C	Permanent	1 $\frac{1}{2}$ Acres	Deep	Moderate on margins
W.T.B.5D	Dry in summer	6 Acres	Shallow	Excellent

### SHEEPLAKES AREA

This area is located in a burned-over section, 2 miles South of Twin Buttes Ranger Station near Burnt Peak road, at an elevation of 4000 feet. There is very little or no willow and other brush along the margins of these meadows:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.6A	Dry in summer	3 Acres	Shallow	Excellent
W.T.B.6B	Permanent lake	2 Acres	Shallow	None
W.T.B.6C	Dry in summer	2 Acres	Shallow	Excellent
W.T.B.6D	Dry in summer	15 X 10 yds.	Shallow	Moderate
W.T.B.6E	Dry in summer	10 Acres	Shallow	None
W.T.B.6F	Permanent lake	1 $\frac{1}{2}$ Acres	Shallow	None
W.T.B.6G	Dry in summer	1 $\frac{1}{2}$ Acres	Shallow	None
W.T.B.6H	Dry in summer	300 X 90 yds.	Shallow	None



### SOUTH MEADOWS AREA

This area is one and one-half miles South of Twin Buttes Ranger Station, at an elevation of 3300 feet. Heavy timber surrounds the areas:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.7A	Dries in early spring	$\frac{1}{2}$ Acre	Shallow	Excellent
W.T.B.7B	Dries in early spring	$1\frac{1}{2}$ Acres	Shallow	Excellent
W.T.B.7C	Dry in late summer	2 Acres	Shallow	Excellent at upper end
W.T.B.7D	Dry in summer	$\frac{1}{2}$ Acre	Shallow	Excellent
W.T.B.7E	Permanent	3 Acres	Deep	None
W.T.B.7F	Dry in late summer	2 Acres	Shallow	Excellent
W.T.B.7G	Dry in summer	40 Acres	Shallow	Excellent
W.T.B.7H	Dries in early spring	$\frac{1}{2}$ Acre	Shallow	Excellent
W.T.B.7I	Dry in summer	60 Acres	Shallow	Moderate
W.T.B.7J	Semi-permanent lake	3 Acres	Moderately deep	None
W.T.B.7K	Dry in late fall			
W.T.B.7L	Dry in late summer	3 Acres	Shallow	Excellent
W.T.B.7M	Dry in summer	1 Acre	Shallow	Excellent
W.T.B.7N	Dries in early summer	6 Acres	Shallow	Excellent
W.T.B.7O	Dries in early summer	2 Acres	Shallow	Excellent

### SURPRISE LAKES AREA

This area is six miles south of Twin Buttes Ranger Station, at an elevation of 4300 feet. The area has been burned over, and huckleberry is the most abundant type of surrounding growth:

W.T.B.8A	Permanent	100 X 50 yds.	Shallow	None
W.T.B.8B	Permanent	70 X 60 yds.	Shallow	None
W.T.B.8C	Permanent	40 X 30 yds.	Shallow	None
W.T.B.8D	Permanent	40 X 30 yds.	Shallow	None
W.T.B.8E	Dry in late summer	20 X 15 yds.	Shallow	Moderate
W.T.B.8F	Permanent	100 X 60 yds.	Shallow	None
W.T.B.8G	Dry in late summer	10 X 6 yds.	Shallow	Moderate
W.T.B.8H	Permanent	10 X 7 yds.	Shallow	None
W.T.B.8I	Permanent	40 X 20 yds.	Shallow	None
W.T.B.8J	Permanent	35 X 25 yds.	Shallow	None
W.T.B.8K	Permanent	30 X 20 yds.	Shallow	None
W.T.B.8L	Permanent	90 X 30 yds.	Shallow	None
W.T.B.8M	Permanent	50 X 25 yds.	Shallow	None
W.T.B.8N	Dry in late summer	80 X 30 yds.	Shallow	Moderate
W.T.B.8O	Permanent	80 X 40 yds.	Shallow	None
W.T.B.8P	Permanent	180 X 60 yds.	Shallow	None
W.T.B.8Q	Permanent	70 X 40 yds.	Shallow	None
W.T.B.8R	Permanent	70 X 30 yds.	Shallow	None
W.T.B.8S	Permanent	15 X 7 yds.	Shallow	None
W.T.B.8T	Permanent	15 X 10 yds.	Shallow	None
W.T.B.8U	Permanent	45 X 10 yds.	Shallow	None



### SAWTOOTH MOUNTAIN AREA

This area is four miles south of the Twin Buttes Ranger Station, at an elevation of 5000 feet. The country is fairly open, although there is some timber on the western slope of the mountain. The margins of the meadows are bordered by willows and huckleberries:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.9A	Dry in late summer	100 X 60 yds.	Shallow	Excellent
W.T.B.9B	Dry in late summer	10 X 12 yds.	Shallow	Moderate
W.T.B.9C	Dry in late summer	10 X 8 yds.	Shallow	Moderate
W.T.B.9D	Dry in late summer	10 X 7 yds.	Shallow	Moderate
W.T.B.9E	Dry in late summer	15 X 12 yds.	Shallow	Excellent
W.T.B.9F	Permanent	85 X 50 yds.	Shallow	None
W.T.B.9G	Dry in late summer	20 X 12 yds.	Shallow	Excellent
W.T.B.9H	Permanent	125 X 50 yds.	Moderate	None
W.T.B.9I	Permanent	100 X 75 yds.	Shallow	Moderate along borders
W.T.B.9J	Dry in early summer	30 X 10 yds.	Shallow	None (2)
W.T.B.9K	Permanent	40 X 20 yds.	Shallow	None
W.T.B.9L	Permanent	30 X 20 yds.	Shallow	None
W.T.B.9M	Permanent	25 X 16 yds.	Shallow	None
W.T.B.9N	Dry in late summer	12 X 10 yds.	Shallow	Moderate
W.T.B.9O	Dry in late summer	12 X 8 yds.	Shallow	Moderate
W.T.B.9P	Dry in early summer	25 X 12 yds.	Shallow	Moderate
W.T.B.9Q	Dry in late summer	30 X 20 yds.	Shallow	Moderate
W.T.B.9R	Dry in early summer	10 X 8 yds.	Shallow	Moderate
W.T.B.9S	Dry in early summer	2 Acres	Shallow	Moderate
W.T.B.9T	Dry in late summer	25 X 12 yds.	Shallow	Moderate
W.T.B.9U	Permanent	20 X 15 yds.	Shallow	None
W.T.B.9V	Dry in Summer	5 X 10 yds.	Shallow	Moderate
W.T.B.9W	Dry in late summer	20 X 15 yds.	Shallow	Moderate
W.T.B.9X	Dry in late summer	10 X 8 yds.	Shallow	Moderate
W.T.B.9Y	Permanent	40 X 12 yds.	Shallow	None
W.T.B.9Z	Permanent	25 X 15 yds.	Shallow	None
W.T.B.9Z1	Dry in summer	10 X 8 yds.	Shallow	Moderate
W.T.B.9Z2	Permanent	20 X 12 yds.	Shallow	None
W.T.B.9Z3	Dry in early summer	12 X 5 yds.	Shallow	Moderate
W.T.B.9Z4	Dry in early summer	12 X 10 yds.	Shallow	Excellent

### EAST BUTTE MEADOWS AREA

This area is four and one-half miles South East of the Ranger Station at an elevation of 3300 feet. This is a large area surrounded by heavy timber:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.10A	Dry in summer	1 X $\frac{1}{2}$ mile	Shallow	Excellent
W.T.B.10B	Dry in early summer	75 X 40 yds.	Shallow	None
W.T.B.10C	Dry in early summer	145 X 35 yds.	Shallow	None



#### HUNCHY PEAK AREA

This area is five miles North West of the Twin Buttes Ranger Station, at an elevation of 4400 feet. It is located in an old burn, with an abundance of marginal willow brush:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.11A	Dry in summer	375 X 275 yds.	Shallow	Moderate
W.T.B.11B	Dry in summer	70 X 60 yds.	Shallow	None

#### SKOOKUM MEADOWS AREA

This area is four miles South West of the Twin Buttes Ranger Station at an elevation of 3300 feet. There is a heavy stand of old growth timber with a marginal willow growth on all sides:

CODE	CONDITION OF WATER	SIZE	DEPTH	BREEDING CONDITIONS
W.T.B.12A	Dry in summer	$\frac{1}{4}$ X $\frac{1}{4}$ Mile	Shallow	Moderate
W.T.B.12B	Dry in summer	1 X $\frac{1}{4}$ Mile	Shallow	None
W.T.B.12C	Dry in summer	250 X 150 yds.	Shallow	Moderate

There are at least four important breeding areas just outside of a five mile radius from the Twin Buttes Ranger Station. Because of time, these areas were not completely surveyed and mapped.

#### SURPRISE MEADOWS AREA - W.T.B.- 13

This area is five miles North of the Ranger Station, one-quarter of a mile west of the Surprise Meadow Way. It is heavily timbered with many meadows and small lakes. It is at an elevation of 2200 feet, and drainage is to the Lewis River. Excellent breeding grounds were found in the area.

#### LONE BUTTE MEADOWS AREA - W.T.B.- 14

This area is five miles South West of the Ranger Station, on the Burnt Peak Road, at an elevation of 3300 feet. It is a large meadow one and one-half miles long and a quarter of a mile wide, with heavily timbered borders. Excellent breeding areas were found in this meadow.

#### SWAMPY MEADOWS AREA - W.T.B.- 15

This area is six and one-half miles North East of the Ranger Station, at an elevation of 3800 feet. There are at least 3 meadows in the area, totaling over 500 acres. The drainage is poor, there is an abundance of heavy timber on all sides, and excellent breeding grounds were discovered.

#### MC CLELLAN MEADOWS AREA - W.T.B.- 16

This area is 10 miles South West of the Twin Buttes Ranger Station, at



an elevation of 3200 feet. There are large, open meadows with heavily timbered borders. Several excellent breeding grounds were seen.

#### DIRECT CONTROL MEASURES, 1934

The direct control measures consisted entirely of spraying oil on water found to contain mosquito larvae. A light grade of Shell Diesel oil was used for this purpose. Oiling began on April 20th and was continued until June 1st. After that time breeding was discontinued. Four C.C.C. laborers were used as oilers, and they used 860 gallons of oil over approximately 480 acres of water surface. The cost of the oil was therefore 16 1/8¢ per acre. The cost of the oil delivered at Twin Buttes was 9¢ per gallon. The actual time spent in oiling was 173 1/2 hours. The Sprayers used were of the Meyers Company knapsack type, and held five gallons. They have been found to be the most satisfactory sprayer generally over the United States for mosquito control activities, and cost approximately \$10.00 each. A very fine spray rather than a stream is essential for good work, and these sprayers meet the requirements. A car was used for transportation where roads would permit, but much of the oiling was done in areas accessible only to pack trains, and this greatly slowed up the progress of the work.

A great deal of time was used in locating and sampling the various areas, as no one knew where the breeding areas were located. Also, the areas were inspected the day after oiling in every case, and if necessary they were oiled again. A second treatment was seldom needed however, since the oilers walked about ten feet apart, abreast, and close watch was kept on the strips completed.

#### NATURAL ENEMIES OF MOSQUITOES AT TWIN BUTTES

There are many natural enemies of mosquitoes in this area, in addition to the severe changes of climate. These include several forms of aquatic insects, amphibians, fish, and no doubt some birds, but the wrigglers are so abundant and their aquatic life is so short that their natural enemies seem to be of little consequence in their control. Parasitic red mites were frequently found in 2's and 3's on adult mosquitoes. It is not known just what effect these mites may have on them.

#### SEMI-PERMANENT CONTROL

This method of control is of course the most satisfactory from every standpoint, although because of expense it cannot always be employed. This type of control has to do with drainage or filling and with the raising or lowering of lake levels.

As is shown in the accompanying tables of the different areas, excellent breeding occurs almost entirely on ground which is flooded for short periods. When mention is made of permanent water, we invariably find that no breeding is present except about the margins which are flooded for but part of the



year.

If then these meadows which offer excellent breeding opportunities can be ditched so that the melting snow water will quickly drain off of them, water will not accumulate long enough to permit the mosquito wrigglers to complete their development. In some instances, small dams may be constructed in order to raise the lake level so that the water is permanently over a greater area. If this can be accomplished, the breeding ground is covered by water and the adult mosquito can not lay her eggs there.

Drainage operations will not only directly influence the mosquito population, but will of course serve to produce better pasture at an earlier date.

The largest and one of the most important breeding areas is found in the Mosquito Lakes Area adjacent to the Twin Buttes Ranger Station. It is recommended that for experimental control purposes the level of this lake be raised so that part of the marginal land will be permanently covered, and that this work be supplemented by a well developed system of ditches so that seepage will quickly flow into the lake and prevent the accumulation of water along the upper margins.

#### REPELLENTS

No satisfactory repellents have been formulated which will give protection against annoyance for longer than several minutes to half an hour. The most satisfactory substance is perhaps Citronella, but this is objectionable to some because of the odor. The following formulae may be helpful:

Oil of Cassia	1 Ounce
Camphorated oil	2 Ounces
Vaseline	3 Ounces

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Oil of Peppermint	1 Ounce
Oil of Cassia	2 Ounces
Vaseline	2 Ounces

Ordinary toilet soap applied to mosquito bites has been found to relieve the irritation, as has also weak ammonia water.



- Summary -

Seven species of mosquitoes were taken during April, May, and June, 1934, in the Twin Buttes Ranger Station Area. These are Aedes hexadontus, Dyar; Aedes aboriginis, Dyar; Aedes communis, De Geer; Aedes fitchii, Felt & Young; Aedes cinereus, Meigen; Aedes aloponotum, Dyar; and Theobaldia impatiens, Walker.

The most important species are Aedes hexadontus, Aedes aboriginis, Aedes communis, and Aedes fitchii. These lay their eggs directly on soil which will be flooded by snow and rain water the following spring. These eggs remain on the soil at least one winter before hatching, and may remain viable for several years if not covered by water in the meantime.

Direct control by spraying oil on infested water reduced the mosquito pest in this area. However, the work was started approximately one month too late for most efficient control, since the season was considerably in advance of normal. The expenditures for the season were approximately as follows: General Foreman, April 16th to June 30th, \$337.50; Mileage and per diem, \$70.75; Four oilers and cook, 155 man days, \$360.15; 860 gallons oil, \$77.40; 4 Meyers Sprayers and accessories, \$45.00; Packer, 4 miles etc., \$45.00. Total, \$935.80.

If direct control is to be attempted in any future year, it is recommended that oil be stored on the ground the fall previous, as packing oil in on the backs of mules early in the spring is a difficult and tedious task.

Personnel and requirements for control by this means may be estimated as follows: 1 Foreman, 5 oilers, 1 cook, 1000 gallons of oil, and pack train for sixty days. The date for beginning the work will depend upon the season, but it should be well in advance of the first freshets.

A start for semi-permanent control is suggested in the Mosquito Lakes Area. The level of the lakes can be raised about three feet by building a dam at their outlets. The marginal ground above these points should be drained with ditches so that the seepage water will flow directly into the lakes. Some willow and alder brush must be cleared out in order that the ground be made accessible to ditching and oiling.

*& this will be done*  
*10/2*

*noted*  
*10/2*  
*7/17/35*





WTB-2- Mosquito Lakes Area.  
Mosquito larvae thrive in the meadows bordering the lakes.



WTB-2-C Detailed view of alders along margin of meadows.  
In some instances larvae were numerous under this brush.





WTB-2-C- Mosquito Lakes Area.  
General view of meadow. Lake meadow.



WTB-2-C- A detailed view of the meadow when flooded.  
A typical breeding place for mosquito larvae.





WTB-5-A- Cayuse Meadow Area.  
A mile long meadow well adapted to mosquito breeding.  
Sawtooth, Lemei and Bird Mountains in distance.



WTB-9-Z-4- Sawtooth Mt. Area.  
One of the smaller temporary water holes where Aedes hexodontus  
were found in abundance.





WTB-5-B Cayuse Meadow. Area. Another large meadow in the Cayuse Area where mosquito breeding was prolific.



WTB-6-A Sheeplakes Area. A saucer-like depression in which mosquito eggs are deposited and hatched when flooded with snow water.





WTB-7-F- South Meadow Area.  
Oilers spraying infested water. This area is entirely dry in early summer.



WTB-7-A- South Meadow Area.  
This meadow is covered with water in spring and produces wrigglers in abundance.





WTB-9-G      Sawtooth Mt. Area.  
A small grassy depression fed by melting snow.










WTB-8-N      Surprise Lakes Area.  
The upper margins of the pond breed mosquitoes when flooded.



FIELD MAPS  
ARE OF  
TWIN BUTTES  
WASHINGTON

SHOWING  
MOSQUITO BREEDING AREAS  
AS SUBMITTED BY  
ANDY ROTH

LEGEND

	ROADS ACCESABLE TO MOTOR TRAFFIC
	TRAILS
	LAKES
	TEMPORARY LAKES
	MEADOWS
	MOUNTAINS
	SWAMPS

DRAFTING - G.F. OSLER.



# STEAMBOAT AREA

R.B.E.

W.T.B. No 1

SCALE 1 in = 1320 ft

T.8.N.

T.8.N.





# MOSQUITO LAKE AREA

W.T.B. No 2.

SCALE 1 in = 1320 ft

T.8N.

T.8N

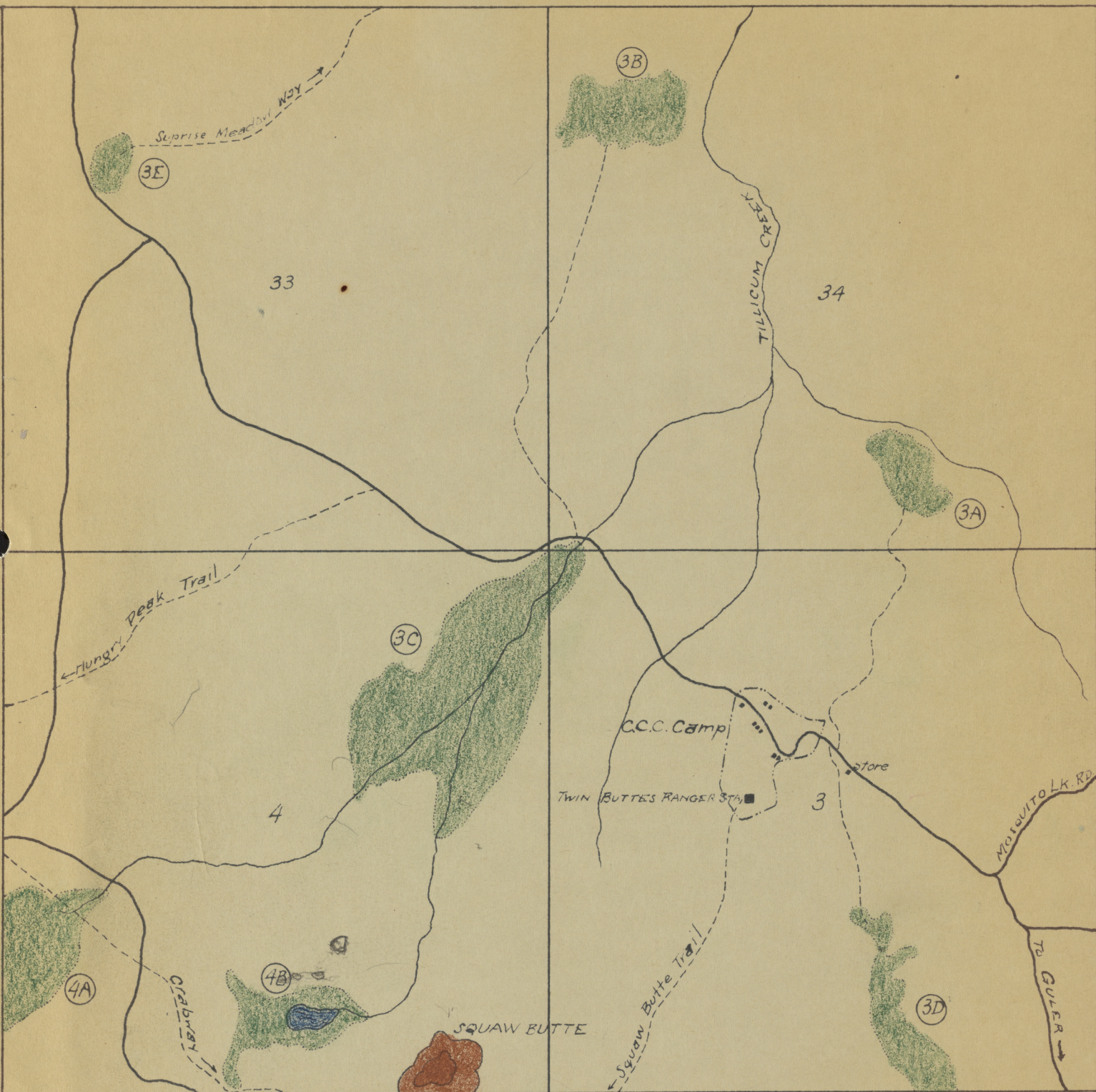




C.C.C. CAMP AREA

W.T.B. No 3

SCALE 1 in = 1320 ft





# SQUAW BUTTE AREA

R.B.E.

W.T.B. No 4. - Continued -

SCALE 1 in = 1320 ft

T7N

T7N





# CAYUSE MEADOW AREA.

R.B.E

W.T.B. Nos. 5 & 6

SCALE 1 in = 1320 ft.

T.7N.

T.7N.





# SOUTH MEADOW AREA

R.B.E.

W.T.B Nos 6 7 & 8.

SCALE 1in = 1320ft.

T.7.N.

T.7.N.





# SAWTOOTH MTN AREA.

R.B.E

WTB Nos 8 & 9.

SCALE 1 in = 1320 ft

T.7N.

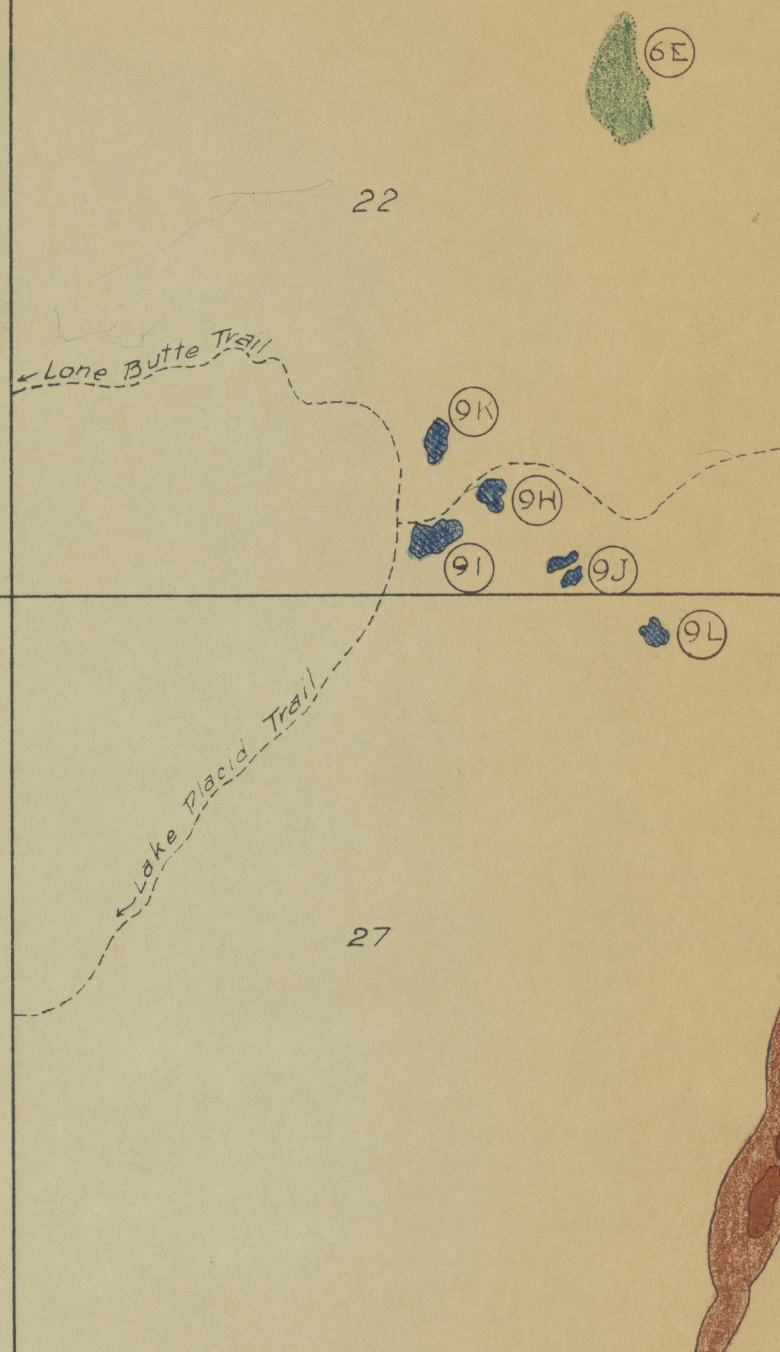
T.7N.





T.7N.

T.7N.





# EAST BUTTE AREA

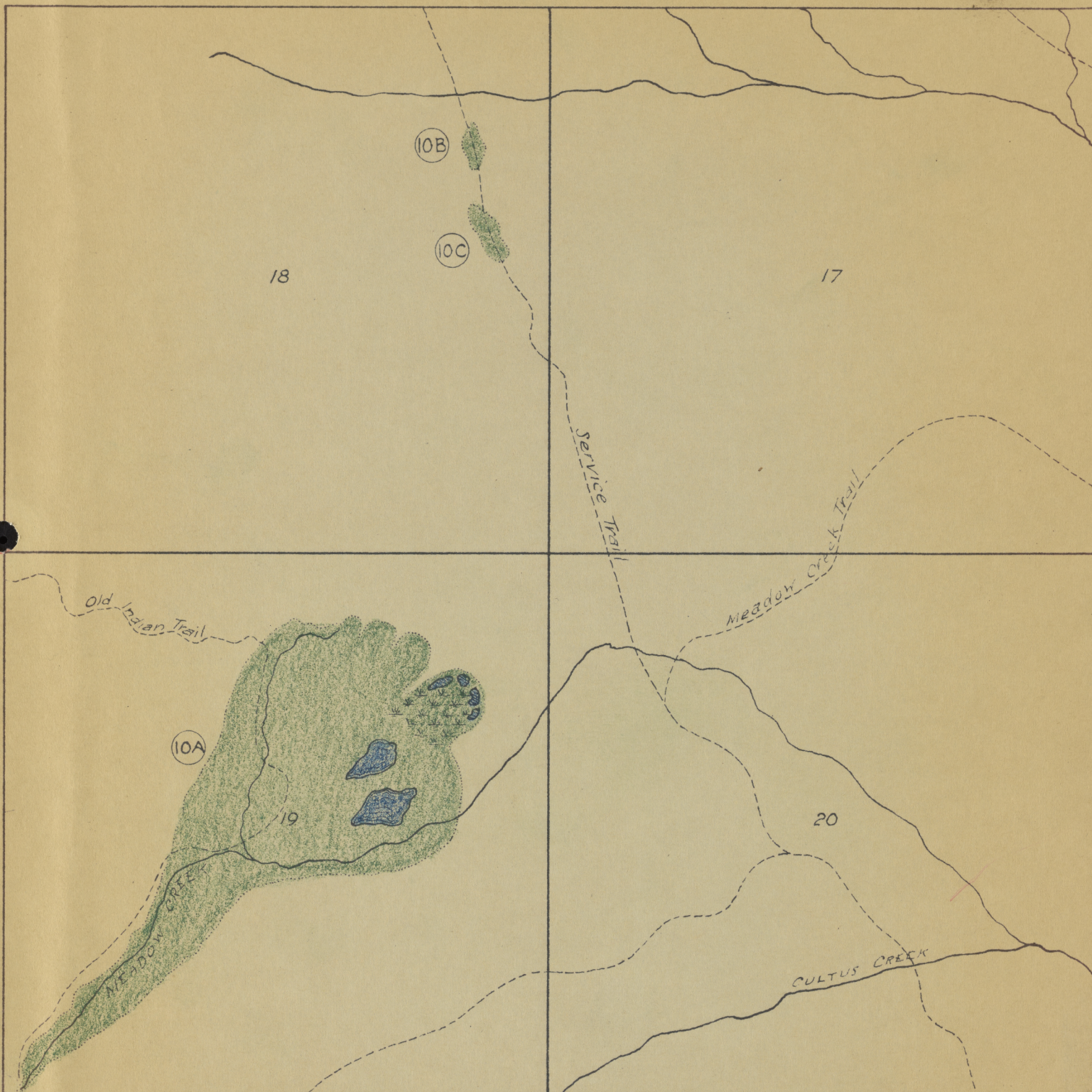
R. 9. E

W.T.B. No. 10.

SCALE 1 in = 1320 ft

T. 7. N.

T. 7. N.





HUNGRY PEAK AREA

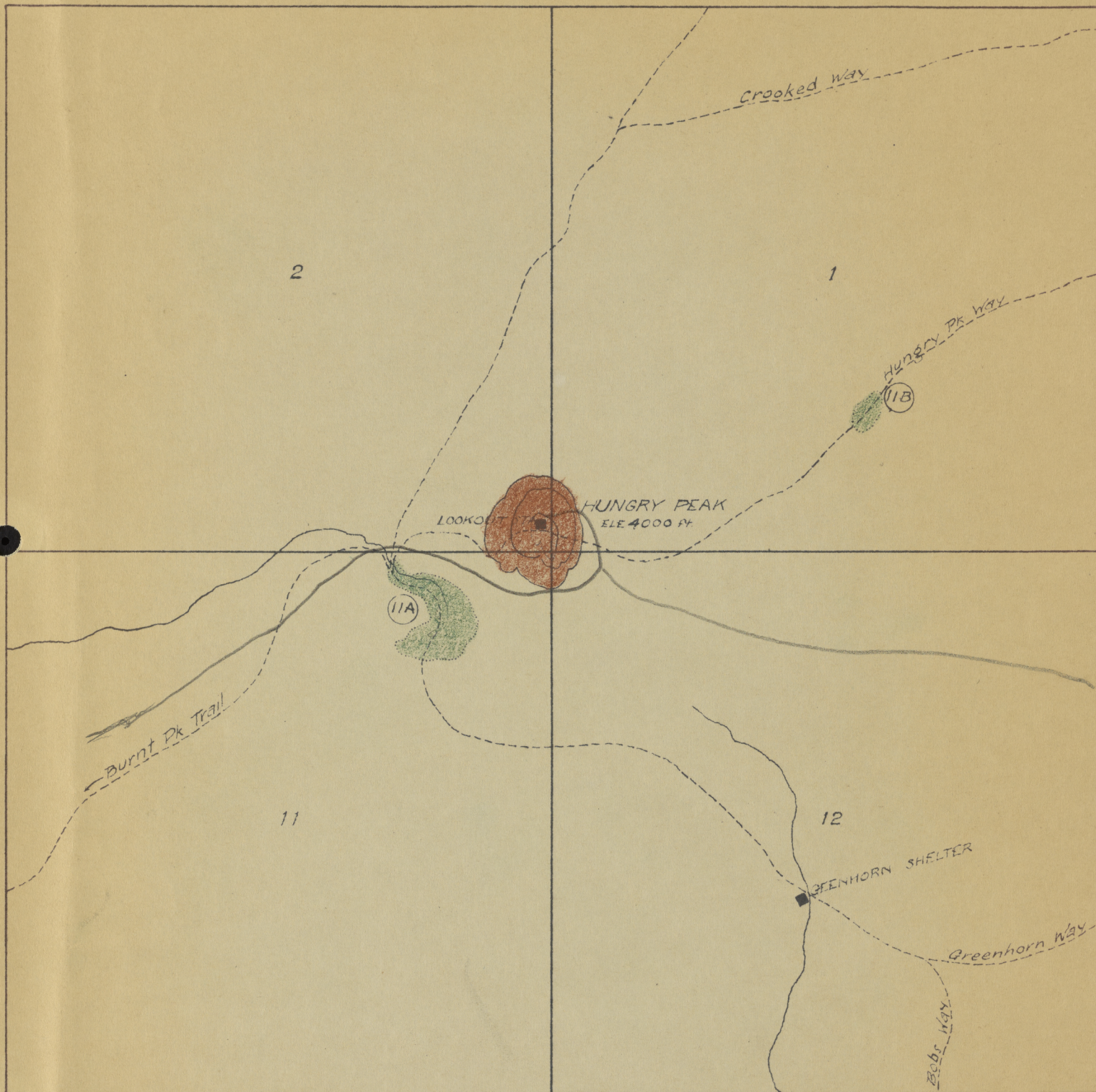
R.7.E.

W.T.B. No 11

SCALE 1 in = 1320 ft.

T.7.N.

T.7.N.





# SKOOKUM MEADOW AREA

W.T.B. No 12.

SCALE 1 in = 1320 ft

T.7N.

T.7N.

